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REPORT NO. 92-06

M621 PLASTIC CONTAINER
PERFORMANCE ORIENTED
PACKAGING (POP) TEST

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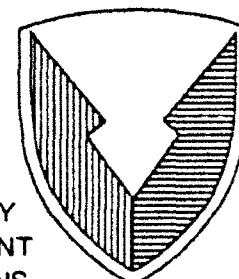
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REPORT NO. 92-06

M621 PLASTIC CONTAINER
 PERFORMANCE ORIENTED PACKAGING (POP) TEST

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PART I

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to perform Performance Oriented Packaging (POP) testing on the M621 container.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of this series of tests was to verify that M621 containers meet United Nations (UN) POP, level II, packaging requirements for transportation and storage of hazardous materials.

D. CONCLUSION. As tested, the M621 container passed level II packaging requirements for POP tests. Although some damage occurred during the corner drop test, there was not enough damage to adversely effect the performance of the container.

E. RECOMMENDATION. As the engineering test showed, the M621 container may not be sufficient for level I packaging, since the container catastrophically failed the 6-foot drop test.

PART 2

22-24 and 27-28 JANUARY 1992; 11 FEBRUARY 1992

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PART 3

TEST PROCEDURES

PERFORMANCE ORIENTED PACKAGING TESTING. Test procedures outlined herein were summarized from the Federal Register, Volume 55, Rules and Regulations, section 178.601 - 178.606. This publication identifies the steps that a package must undergo to be considered acceptable for POP requirements. The tests that were conducted on the test specimens are synopsized below.

A. STACKING TEST. Three test samples were required for each different packaging. The test sample must be subjected to a force applied to the top surface of the test sample equivalent to the total weight of identical packages which might be stacked on it during transport. The minimum height of the stack, including the test sample, must be 3.0 meters (10 feet). The jerricans and composite packaging 6HH, intended for liquids, were subjected to the stacking test for a period of 28 days at a temperature of not less than 40 degrees Centigrade (104 degrees Fahrenheit).

B. VIBRATION TEST.

1. Three sample packagings, selected at random, were filled and closed as for shipment. The three samples were placed on a vibrating platform that has a vertical double-amplitude (peak-to-peak displacement) of one inch. The packages were constrained horizontally to prevent them from falling off the platform, but were left free to move vertically, bounce, and rotate.

2. The test was performed for one hour at a frequency that caused the package to be raised from the vibrating platform to such a degree that a piece of material of approximately 1.6mm (0.063-inch) thickness could be passed between the bottom of any package and the platform.

C. DROP TEST. The test samples were filled to 96 percent of their capacity for solids and 98 percent in the case of liquids, with the inert material being of equal or higher specific gravity than normally filled the package. Paper and fiberboard containers were preconditioned for a period of 24 hours before testing. Plastic containers were preconditioned to -18.0 degrees Centigrade (0 degrees Fahrenheit) before testing. Drop height for packing group I was 5.9 feet, packaging group II was 3.9 feet, and packaging group III was 3 feet. For containers containing specific gravity exceeding 1.2 the drop height for packaging group I was 4.9 feet, packaging group II was 3 feet, and packaging group III was 2.2 feet. The number of containers dropped and the drop orientation are as follows:

<u>Type</u>	<u>Number</u>	<u>Orientation</u>
Drums	3	Containers must strike the target diagonally on the chime or circumferential seam or edge.
	3	Containers must strike the target on the weakest point not tested by the first drop such as closure, seam on drum body, etc.
Boxes	1	Flat to the bottom.
	1	Flat to the top.
	1	Flat to the long side.
	1	Flat on the short side.
	1	On the container corner.

PART 4

TEST EQUIPMENT

A. TEST SPECIMEN.

- | | |
|-----------------|------------------------|
| 1. Description: | M621 Container |
| 2. Height: | 14.25 inches (36.20cm) |
| 3. Width: | 5.75 inches (14.60cm) |
| 4. Length: | 13.75 inches (34.92cm) |
| 5. Weight: | 55 pounds (25kg) |

B. COMPRESSION TESTER.

- | | |
|-----------------------|------------------------|
| 1. Manufacturer: | Ormond Manufacturing |
| 2. Platform: | 60 inches by 60 inches |
| 3. Compression Limit: | 50,000 pounds |
| 4. Tension Limit: | 50,000 pounds |

C. TRANSPORTATION SIMULATOR.

- | | |
|------------------|--------------------|
| 1. Manufacturer: | Gaynes Laboratory |
| 2. Capacity: | 6,000-pound pallet |
| 3. Displacement: | 1/2-inch Amplitude |
| 4. Speed: | 50 to 400 rpm |
| 5. Platform: | 5 foot by 8 foot |

PART 5

TEST RESULTS

A. STACKING TEST. During the stacking test, two M621 containers were subjected to 730 pounds compression to the top of the container to simulate an equivalent 16-foot-high stack. One container was subjected to 1,960 pounds to the side to attempt to simulate a "worst case" orientation. The 1,960-pound load was also used to simulate a 16-foot-high stack. No damage was noted during the stacking test.

B. VIBRATION TEST. During the vibration test, three M621 containers were vibrated for 1 hour each at 250 rpm to provide a .063-inch gap under the containers. Each container was oriented with a different face against the vibration table. No damage was noted during the vibration test.

C. DROP TEST. Five containers were then drop tested after temperature conditioning to approximately 0 degrees Fahrenheit oriented to impact to the top, the bottom, the long side, the short side, and a corner of the containers from a height of 3.9 feet. The exact preconditioning temperatures at the times immediately before the drop tests are shown below.

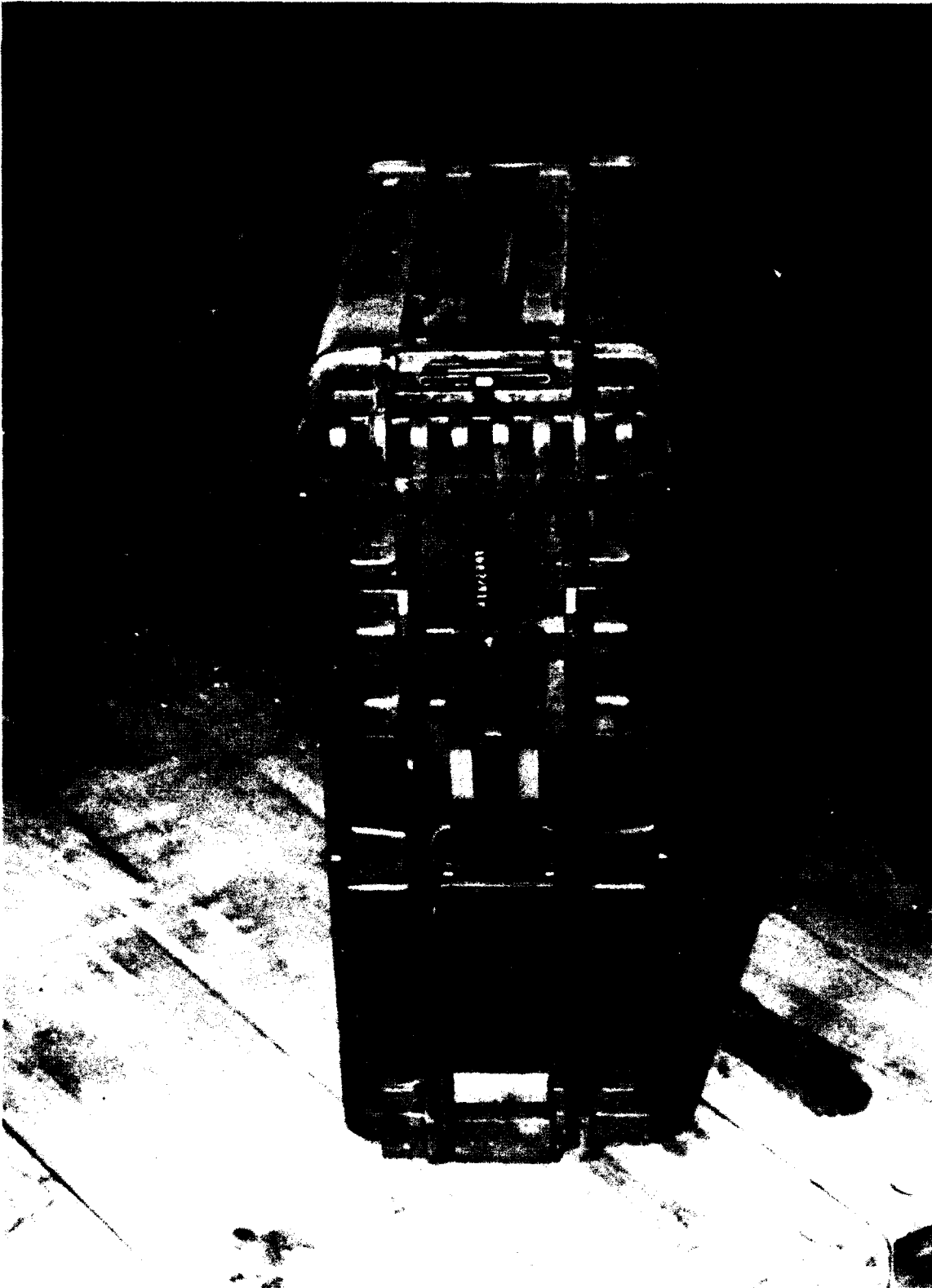
Results from Environmental Preconditioning of M621 Container Prior to Drop Testing on 2 February 1992			
Conditioning Time	Internal Container Temp. Deg./F.	External Container Temp. Deg./F.	Conditioning Chamber Temp. Deg./F.
12:19:03	2.4	-7.6	-13.2
12:34:03	0.7	-12.0	-17.5
12:49:03	-0.9	-13.3	-18.0
13:04:03	-2.3	-13.6	-17.7
13:23:27	-3.7	-6.8	-3.6
13:56:27	-3.2	-2.4	2.4 *
14:11:27	-2.7	-2.3	-3.7
* - door to chamber was opened momentarily			

Only the corner drop showed some damage (see photos nos. 1 - 5). Three hinge attachment points out of eight were damaged. One of the damaged attachment points was completely severed, and two of the points had partial cracks.

D. ENGINEERING TEST. Prior to POP testing, a 6-foot corner drop test was performed on one M621 container to determine whether any problems would occur during later tests. The container failed catastrophically at the hinges (see photo no. 6). Since this test was chosen to simulate a "worst case" test for level I POP testing, the results have no impact on the level II POP test results (see recommendation).

PART 6

PHOTOGRAPHS



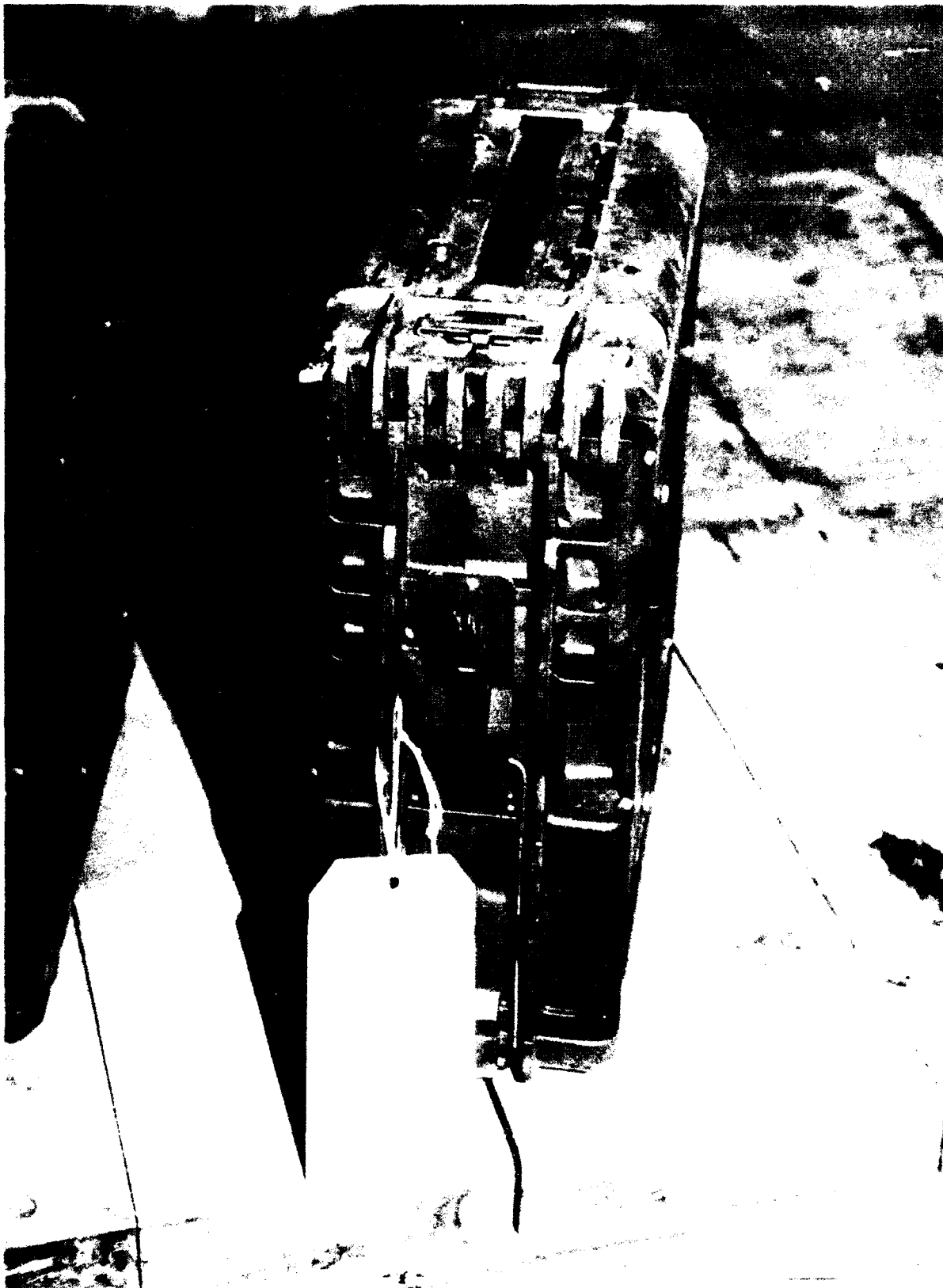
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Photo No. AO317-SPN-92-147-1141. This photo shows an undamaged container following drop test to the top face.



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Photo No. AO317-SPN-92-147-1136. This photo shows an undamaged container following drop test to the top face.



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Photo No. AO317-SPN-92-147-1138. This photo shows the container with some damage to the hinge. Note, the cracks in the right three attachment points.



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Photo No. AO317-SPN-92-147-1139. This photo shows the container with some damage to the hinge. Note, the cracks in the right three attachment points.



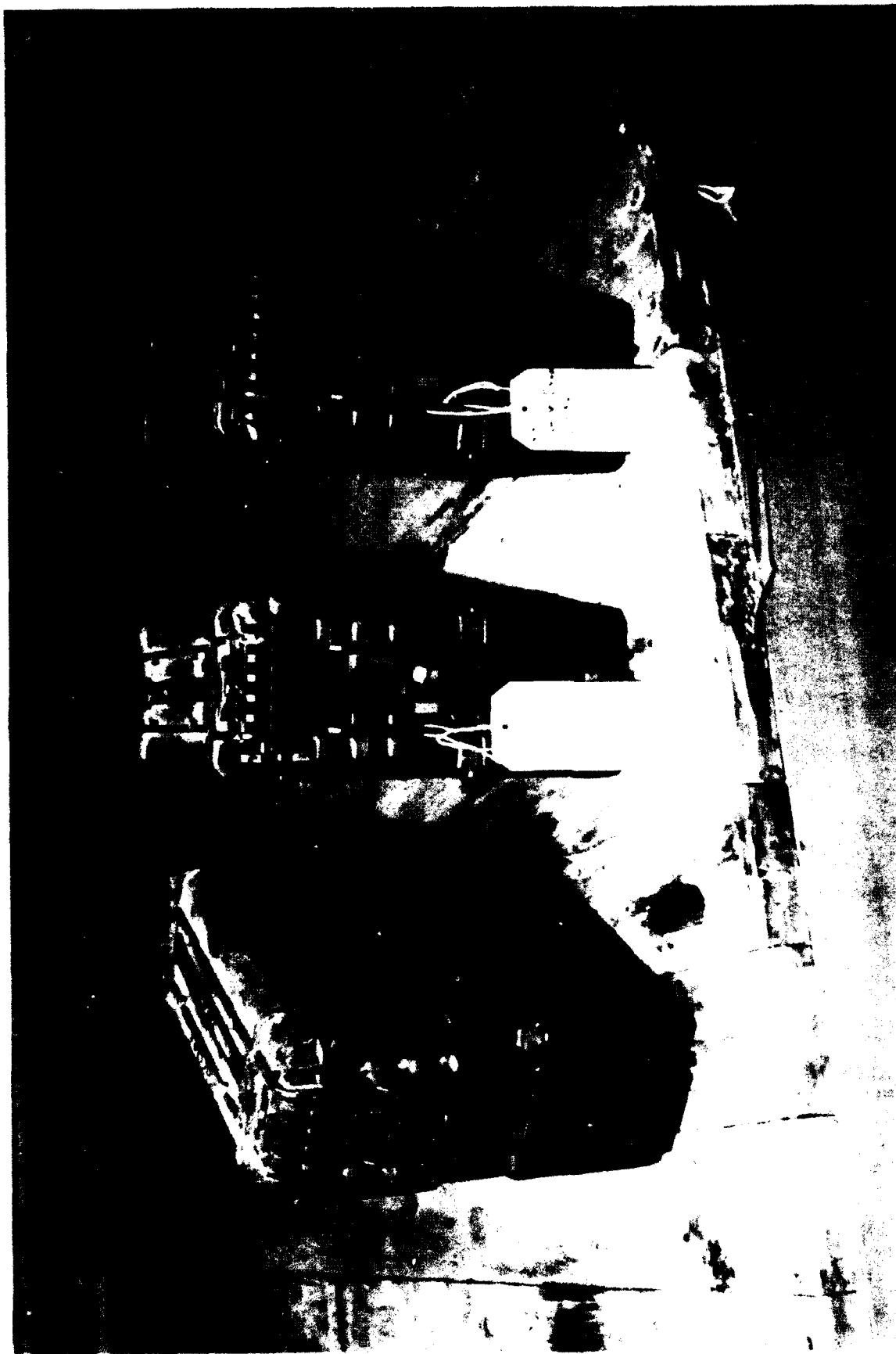
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Photo No. AO317-SPN-92-147-1143. This photo shows the disassembled hinge of the corner dropped container. Note, the attachment point which was completely severed.



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Photo No. AO317-SPN-92-147-1140. This photo shows the catastrophic results of the level I packaging engineering test. Note, the completely severed hinge.



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Photo No. AO317-SPN-92-147-1142. This photo shows three previously tested containers. From left to right: dropped to the top face, dropped 6 feet to the corner, and dropped 3.9 feet to the corner.